Marine Automated Command And Control Systems: Lifting The Fog Of War

CSC 1993

SUBJECT AREA - C4

## EXECUTIVE SUMMARY

Title: Marine Automated Command and Control Systems: Lifting the Fog of War

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Thesis: The Marine Corps is well on its way to tactical computer system compatibility in the 21st Century. The Marine Tactical Command and Control System (MTACCS) provides us a conceptually solid baseline for greater USMC and inter-Service inter-operability in future.

Background: In a recently released document, "C4I for the Warrior," the Joint Staff proposes a far-sighted plan to support the Joint Task Force Commander with a seamless, secure, interoperable global network by the year 2010. This global C4I network will provide the battlefield commander with access to all the information he needs when, where and how he wants it. The Marine Corps, under the MTACCS umbrella, has fielded a number of integrated C2 systems which support the MAGTF commander fairly well. The future promises even greater interoperability and utility to the commander. Continued adherence to USMC, joint, and commercial interoperability standards will guarantee that future MAGTF commanders are full players in the high-tech world envisioned in "C4I for the Warrior."

Recommendation: The Marine Corps should continue to develop and field interoperable C4I systems to support the MAGTF commander.

## OUTLINE

Thesis: The Marine Corps is well on its way to tactical computer system compatibility in the 21st Century. The Marine Tactical Command and Control System (MTACCS) provides us a conceptually solid baseline for greater USMC and inter-Service inter-operability in future.

# Report Documentation Page

*Form Approved*
*OMB No. 0704-0188*



| 1. REPORT DATE | 2. REPORT TYPE | 3. DATES COVERED |
|---|---|---|
| **1993** | | **00-00-1993 to 00-00-1993** |

| 4. TITLE AND SUBTITLE | 5a. CONTRACT NUMBER |
|---|---|
| **Marine Automated Command And Control Systems: Lifting The Fog Of War** | 5b. GRANT NUMBER |
| | 5c. PROGRAM ELEMENT NUMBER |
| 6. AUTHOR(S) | 5d. PROJECT NUMBER |
| | 5e. TASK NUMBER |
| | 5f. WORK UNIT NUMBER |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **United States Marine Corps,Command and Staff College, Marine Corps University,2076 South Street, Marine Corps Combat Development Command,Quantico,VA,22134-5068** | 8. PERFORMING ORGANIZATION REPORT NUMBER |
| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) | 10. SPONSOR/MONITOR'S ACRONYM(S) |
| | 11. SPONSOR/MONITOR'S REPORT NUMBER(S) |

12. DISTRIBUTION/AVAILABILITY STATEMENT
**Approved for public release; distribution unlimited**

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

| 16. SECURITY CLASSIFICATION OF: | | | 17. LIMITATION OF ABSTRACT | 18. NUMBER OF PAGES | 19a. NAME OF RESPONSIBLE PERSON |
|---|---|---|---|---|---|
| a. REPORT **unclassified** | b. ABSTRACT **unclassified** | c. THIS PAGE **unclassified** | **Same as Report (SAR)** | **16** | |

# Marine Automated Command and Control System: Lifting the Fog of War

There is nothing more frightening
Than ignorance in action.
- Goethe

## INTRODUCTION

Not knowing what is happening in his battlespace, being blind to the tactical and operational situation, and being unable to communicate his orders and intent is the worst nightmare of any battlefield commander. Frightening because the commander knows he is acting out of ignorance, precisely what Goethe warned against.

In recent decades, the American military has taken great strides to use modern computers to assist the commander with his command and control (C2) functions. Automating certain C2 functions is one way that we exploited America's advantage in

computer technologies. And the trend is for even greater automation in future. Acknowledging this trend, we use the term "C4I," for command, control, communications, computers, and intelligence, to capture the broader scope that we normally attach to C2 and their supporting functions.

A new Joint Staff publication, C4I for the Warrior, describes the joint commander's battlefield information needs and contains a roadmap to achieve a "...seamless, secure, interoperable global C4I network..." which provides the battlefield commander access to all the information he needs when, where and how he wants it. (4:3)

Marine C2 planners today are challenged to assess the commander's current and planned C4I capabilities and to ensure that they encompass the Joint Staff's new C4I vision, in the near-, mid- and long-term. This paper discusses this challenge, starting with the basics by briefly describing the operational C2 functions that our computer systems are being designed to automate. We then describe the current status of the USMC automated C4I systems and discuss possible migration paths to the joint concept envisioned in C4I for the Warrior.

## THE REQUIREMENT:
## Focus on the Commander

The focus of all Marine C2 is the Marine Air-Ground Task Force (MAGTF) commander. The MAGTF commander--the warrior--must be able to:

* see and understand his present state;
* establish a vision of a future end state;
* articulate a unifying concept of operation; and

* invoke force of will to move his forces.

He does this to concentrate decisive combat power at the time and place it is required while caring for and protecting his own forces. And he does so under conditions that are hostile, confusing, stressful, dynamic, and lethal. (1:1-2)

The MAGTF commander must decide upon those items of information critical to victory, and use this information to determine the enemy's critical vulnerability. He then decides how to shape the battle to expose those enemy weaknesses. (8:2-4) The MAGTF commander's C4I system must support all aspects of the command and control challenges listed above. It must allow him to peer through the fog of war, making and disseminating his decisions rapidly. Operational tempo on the modern battlefield is increasing. As FMFM 3 states:

> More than ever before, a command and control system must support shorter decision cycles and instantaneous flexibility across vast distances of time and space. ...The measure of command and control effectiveness is simple: either our command and control works faster that the enemy's decision-execution cycle or the enemy will own our command and control. (8:2)

The commander's C2 support system incorporates a number of tools to help him achieve and maintain critical operational speed:

* Trained and experienced subordinate leaders;
* Well-defined doctrine;
* Clear and understood chain of command;
* Reliable communications; and
* Fused and relevant information systems.

All of these tools are important to battlefield success, and the Marine Corps must continue to refine each of them. But let's focus on the last two instruments--information and the means of transporting that information into and around the battlefield.

In the remainder of this paper, we will answer the following:

* What tools does the MAGTF commander have now (1993)?
* What tools will he have in the mid-term (1993-2000)?
* What tools can he expect in the long term (2000+)?

## WHERE WE ARE:
## C4I Systems in 1993

The Marine Corps implemented a number of automated tactical data systems that provide the MAGTF commander limited support in every battlefield functional area (BFA). Our fielded systems are most useful to the staff section or major subordinate command with the preponderance of responsibility for that BFA. For example, the artillery regiment's commander is served well by his fire support software, as is the S/G-1 by his personnel support system. Unfortunately, the MAGTF commander has access to these systems only indirectly through these staff officers and his subordinate commanders. The focus is not on the MAGTF commander. He has no automated means of directly extracting information from these systems.

That is not to say that fielding the current inventory of automated BFA support systems has not been successful. In fact, MAGTF commanders in 1993 owe a debt to the far-sighted Marine C2 planners of the mid-1960s who first conceived of the Marine Tactical Command and Control System (MTACCS).

The requirement for the MTACCS system was identified in early 1967. (14:1-2) MTACCS was then envisioned as the integration of separate automation-assisted MAGTF C2 component systems supporting tactical operations. Each BFA--fire support, logistics, air command and control, personnel, etc.--was to be

supported with a separate subsystem, with data from these sub-systems fully integrated for the commander's use. (13:1) In the MTACCS schema, data compatibility or interoperability among the subsystems was a primary goal, and is defined as:

> interoperability - 1. The ability of systems, units or forces to provide services to and accept services from other systems, units or forces and to use the services so exchanged to enable them to operate effectively together. 2. The condition achieved among communications-electronics systems or items of communications-electronics equipment when information or services can be exchanged directly and satisfactorily between them and/or their users. The degree of interoperability should be defined when referring to specific cases. (JCS Pub 1)

This interoperability was to be achieved through adherence to the standards and protocols outlined in the Tactical Interface Design Plan (TIDP).

Today the MAGTF commander enjoys the services of many of the component subsystems developed under the MTACCS umbrella. (See Table 1 for these subsystems). For example, the Marine Corps Air Command and Control System (MACCS) is a mature, well-developed system supporting the MAGTF commander through his Air Combat Element (ACE) commander. So too, the Marine Air Ground Intelligence System (MAGIS) supports the G/S-2 who, in turn, supports the commander. The MAGTF commander is supported through his staffs and subordinate commanders across all BFAs with generally solid, functional automated C2 component systems.

**TABLE 1**

**Battlefield Functional Areas Supported by MTACCS Subsystems**

| Battlefield Functional Area | Supported Staff/Element | MTACCS Subsystem |
|---|---|---|
| Personnel | S/G-1 All | Marine Integrated Personnel System |
| Intelligence | S/G-2 SRIG/All | Marine Air Ground Intelligence System |
| Position Location | All | Position Location and Reporting System |
| System Integration | All | Tactical Combat Operations* |
| Fire Support | S/G-3 GCE | Advanced Field Artillery Tactical Data System |
| Logistics | S/G-4 CSSE | Marine Integrated Logistics System |
| Communication Planning | CommO/G-6 | Systems Planning Engineering and Evaluation Device |
| Aviation Planning | G-3/AvOff ACE | Marine Air Command and Control System |
| * not available in 1993 | | |

Yet in 1993 the MAGTF commander lacks the automated means for receiving, fusing, displaying and disseminating the selective input from the component systems. He needs greater flexibility than the "stovepipe," hierarchical component systems can provide. He needs an integrating mechanism to make the flood of information pouring into the command post (CP) more useful to him. (See Figure 1). He is inundated with more information, in more formats, on diverse displays, and in more locations than he can effectively absorb. (4:10)

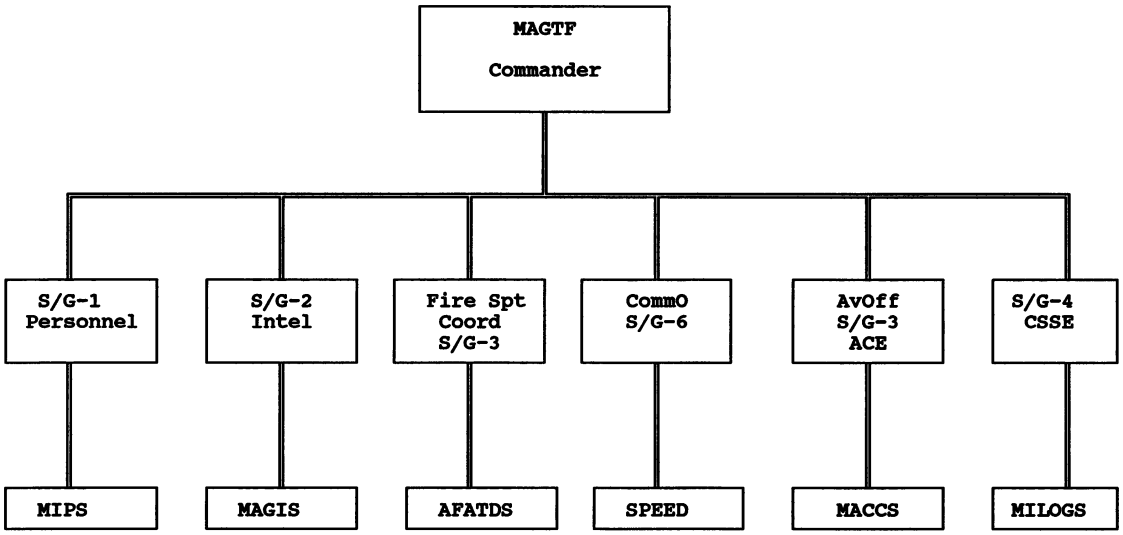


**Figure 1**

**Stovepipe Support to MAGTF Commander**
**1993**

Why this integrating mechanism is not already available is due to a variety of historic institutional, programmatic, budgetary, and technical reasons. (16:61) The effect, though, is that the commander is not directly supported by his automated C4I2 systems with information tailored for his use. He could be better served (and will be in future) by a better-integrated system.

In the communications, or data transport arena, the Marine Corp's current digital data communications architecture consists of a mix of commercial and tactical computers operating in conjunction with a Banyan local area network (LAN). However, there are significant shortfalls in the data transport capability. A recent communications study estimated the near-term bandwidth shortfall for external connectivity to a Marine

Expeditionary Force (MEF) to be 3.37 megabit/second, or the equivalent of 157 medium-speed modem links. In short, it is a daunting deficiency. (20:16)

In the field and on ship, Marines are now using any available means to overcome this bandwidth shortfall. Their innovative work-arounds run the gamut from higher-speed modems connecting widely distributed LAN servers, to human couriers physically transporting data disks from site to site. (20:5) The data gets passed, but not as efficiently as most communications officers or their commanders would like.

And in fairness, today's data communications deficiencies are not unique to Marines. In reflecting on the Gulf War, Mr. Richard Howe, the Department of Defense's (DOD) current director of theater and tactical command, control and communications stated:

> Throughout the Gulf War, C4I2 network flow was a constant concern. Things got so bad at one point in mid-1991 that the data networks were overwhelmed. ...The problem, say communication officials, is that no matter how big your C4I2 pipelines are, they're not big enough. The demand for capacity from users is insatiable. (11:21)

Managing the "insatiable" demand for data paths is, and will continue to be, a challenge to Marine communication officers in the near future.

While aboard amphibious shipping, communications is even more problematic. The data link problems mentioned above that face land-based Marine warriors are amplified as the MAGTF commander, as Commander of the Landing Force (CLF), attempts to merge his C2 operations with that of the Commander, Amphibious Task Force (CATF). This is a critical problem, and one that is being aggressively attacked by the Navy-Marine communications

planners.

## WHERE WE ARE GOING IN THE MID-TERM:
## C4I System in 2000

By the end of the decade, the Marine Corps and DOD will have developed and mandated a collection of Joint Interoperability Standards for all tactical and administrative data systems to address the incompatibility problems that we have now in 1993. The reasons are obvious:

* non-interoperable systems waste money; and

* non-interoperable systems jeopardize Service components' contributions to joint warfare. (12:36)

The Joint Staff's C4I for the Warrior mid-term solution calls for a two-stage move to interoperability by 2000. The first stage uses a quick fix method and the second phase employs a modular building block approach to software development.

The quick fix is intended for stovepipe subsystems that are now functional to commanders but are not planned to undergo a major software revision.

> Quick fixes include the installation of translation devices that interpret nonstandard message and data formats and protocols and produce common outputs that can be readily exchanged via standard transmission paths. (4:14-15)

The quick fix is a relatively easy enterprise for software and hardware engineers. But its value is limited insofar as it requires an additional device interface and consumes processing power to effect the protocol translation.

The second stage of interoperability improvement described in C4I for the Warrior calls for the development of standardized modular building blocks to be incorporated into all new software products and those undergoing substantial revision. This

building block approach is very effective. Seeing the value of this approach, the Services have been incorporating similar modular or layered techniques to software development since the mid-1980s. The Marine Corps' contribution has been the on-going development of the Marine Common Application Support Software (MCASS).

Conceptually, MCASS is a library of software routines performing functions (database queries, graphics creation, network access, etc.) which are common to all battlefield applications, and which can be incorporated in numerous software products. For example, there is no fundamental difference in the way that the Tactical Air Operations Module (TAOM) programmer enters air "tracks" into a database and the way a Position Location and Reporting System (PLRS) programmer enters position location data into the PLRS database. The function is the same, and if standardized, would significantly save programming effort and increase software quality. Once developed, the MCASS libraries will be part of a standardized software toolkit available to applications programmers regardless of the hardware and operating system that any particular application runs on. Continuing the MCASS development, therefore, is consistent with the overarching DOD approach, and will yield future application interoperability and standardization.

Yet another USMC interoperability initiative which will bear fruit by the year 2000 is MARCORSYSCOM's plan to establish a Systems Integration Environment (SIE). The SIE is planned as a controlled environment for the assessment of new C2 hardware or software products. (13:1-6) The SIE will mirror the C4I configuration of a MAGTF operating either alone, or as part of a

Joint Task Force. It will present a common "gate" through which all FMF-bound data systems can be funneled and their interoperability evaluated. The SIE will give the USMC the capability to:

* Assess and improve the interfaces, interactions, and interoperability among task force C4I systems;

* Evaluate proposed C4I system modifications, enhancements and design refinements from a performance, interoperability and user acceptance viewpoint;

* Assess proper implementations of standards, protocols, and interfaces by C4Isystems; and

* Support operational testing and evaluation by the Marine Corps Operational Test and Evaluation Activity (MCOTEA). (13:1)

Access to the SIE -- a MAGTF CP in a laboratory -- will be invaluable to the programmers and product managers trying to evaluate the operation of new and modified software and equipment. It will protect the Fleet Marine Force (FMF) users from interoperability problems which otherwise might escape detection. Better quality, more interoperable systems will result.

Data communications afloat will also have improved greatly by the year 2000. Embarked MAGTF commanders will have access, through the MTACCS, to the Navy Tactical Command System-Afloat (NTCS-A). A component of the far-sighted Navy COPERNICUS project, NTCS-A will provide sailors and embarked Marines integrated, real-time battlespace data. It will provide connectivity to all shipboard communications including all tactical data links (TADILS), satellite communications and inter-ship fleet broadcasts. By 1996, NTCS-A will be placed on all major vessels, including the larger amphibious ships (LHDs, LHAs

and possibly LCCs).(15:4) Integrating MTACCS and NTCS-A will allow for more rapid amphibious planning. It will also provide the robust C4I2 support required if the embarked MAGTF commander is named commander of a Joint Task Force for an operation.

The Marine Corps is right in step with the Joint Staff's C4I2 improvement plan for the mid-term. Although the technicalities of these improvements will be transparent to the MAGTF commander, he will clearly see the benefits. By the turn of the century he will enjoy more coherent information from all of his automated battlefield systems displayed in a more easily understood manner.

## WHERE WE ARE GOING IN THE LONG-TERM: C4I System After 2000

It is not until after the turn of the century that we will fully realize the vision contained in C4I for the Warrior. The document anticipates great technological advances, particularly in the following areas: (4:15)

* powerful artificial intelligence tools;
* standardized multilevel security techniques;
* standardized data compression and data fusion tools; and
* standardized common operating and interface environments.

Each of these advancements will multiply the value of C4I systems to the battlefield commander and concurrently decrease the cost of the military systems investment. At this point it is impossible to predict how these advancing technologies will be embodied in specific products. But it is clear that remarkable, if not revolutionary, advancements will be made in each of those areas.

Military designers will be working closely with industry

sources to ensure that commercial interoperability standards are incorporated into all C4I projects. Moreover, military planners will be active with standards-making bodies such as the International Standards Institute (ISO), the Consultative Committee on International Telegraphy and Telephony (CCITT) and the American National Standards Institute (ANSI) to see that the interests of the military are represented when standards are set. (17:86) The value of commercial interoperability standards to the military cannot be overstated.

But what could this mean to the MAGTF commander? How will he get the information needed be better able to see and shape the battlespace? As envisioned in C4I for the Warrior, all warriors will access secure, robust multimedia networks linking local, theater, and national information sources. Military systems, regardless of Service origin, will be interoperable, sharing data over an vast array of communication paths. These paths, (having been designed around industry data transmission standards), will incorporate the most efficient mix of military and commercial data transport facilities. In the Joint Staff's vision, this network of interconnected communications links is referred to as the infosphere, "the total combination of information sources, fusion centers, and distribution systems that represent the C4I resources a warfighter needs to pursue his operational objectives."(4:4) Future MAGTF commanders will be best served by having his MTACCS evolve, in conjunction with the Navy's NTCS-A, to be fully integrated components of this joint infosphere.

## CONCLUSION

C4I for the Warrior sets forth a bold proposal for future

command and control support for the American warrior. A roadmap for the joint communications and data interoperability, it should be embraced by all DOD C4I2 planners. In addition, Marine planners should continue to support the far-sighted MTACCS concept and Marine communications improvement programs which will ensure that future MAGTF commanders will remain full player in the rapidly-progressing joint C4I2 arena. The Marines are on the right track, let's keep it that way!

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